DOCUMENT RESUME

ED 397 738 HE 029 338

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TITLE The Local Impact of Higher Education. AIR 1996 Annual Forum Paper.
PUB DATE May 96
NOTE 35p.; Paper presented at the Annual Forum of the Association for Institutional Research (36th, Albuquerque, New Mexico, May 5-8, 1996).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Community Colleges; *Econometrics; Economic Factors; *Economic Impact; Higher Education; Institutional Research; *Knowledge Level; *Metropolitan Areas; Private Colleges; Public Colleges; *School Community Relationship; *Socioeconomic Influences; Urban Universities
IDENTIFIERS *AIR Forum; Impact Evaluation

ABSTRACT

This paper classifies the university economic impacts on a local community into their short- and long-term effects. The study then offers a classification scheme of university communities by the size of their regions and by their influences. Next, the paper suggests ways that economic impacts vary across university types and describes and critiques examples of short- and long-term studies that have been done. The local expenditure impact of a university is immediately noticeable. Knowledge impacts affect the community over a longer term. The extent of the economic impact of a college or university is related to the range of its influence and the character of the community in which it is located. Institutions in college towns have large regional expenditure and small knowledge impacts; metropolitan schools with regional reputations have small expenditure and large knowledge impacts. Economic impact studies previously done include income expenditure studies, American Council of Education studies, economic base studies, input-output studies, econometric studies, and knowledge impact studies. Seven exhibits presenting the data are included. (Contains 86 references.) (CK)

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The Local Impact of Higher Education

for presentation and discussion at the annual meeting of the Association for Institutional Research
Albuquerque, NM
May, 1996

by

Kevin Stokes, Jefferson Community College, Louisville, KY
Paul Coomes, University of Louisville, KY

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This paper was presented at the Thirty-Sixth Annual Forum of the Association for Institutional Research held in Albuquerque, New Mexico, May 5-8, 1996. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

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Abstract

Institutions of higher education have broad economic impacts on their host communities. Expenditure impacts result from short-term cash flows of college payrolls and vendor payments. Knowledge impacts from the production and transmission of ideas yield increased lifetime earnings for alumni. The impact of an institution depends upon the range of its influence and the size of its community. Institutions located in rural areas have large regional expenditure impacts and small regional knowledge impacts. Regional schools located in metropolitan areas have relatively small expenditure and large knowledge impacts. Nationally known metropolitan schools have both large local expenditure and knowledge impacts.

We develop a typology of institutional impacts and review the primary methods used in published impact studies. Most of the studies are of short term impacts and use a methodology developed by Caffrey and Isaacs. However, precisely because it strives to be comprehensive, the Caffrey-Isaacs method leaves considerable room for judgment by the investigator in the choice of assumptions, accounting details, and multipliers. Other studies use input-output models, econometric models, and other variants of Keynesian and export- base systems to measure the impact of universities on local economies.

We also review the growing literature on the long term knowledge effects of universities. Most follow a variant of the Becker literature. They sometimes differ, however, in the degree to which they differentiate between the impact of the university on local residents and the local labor force, versus the impact on nonresidents and the economy of the rest of the world. Finally we make some judgments on the advantages and disadvantages of the different methods, providing recommendations on the choice of methods depending upon the character of the institution and its community.

Introduction

The 1990s have seen a continuation of global competition and increased pressure on state government budgets. As a result public higher education has been under pressure to produce more with less money. Universities and colleges have been forced to justify themselves to a skeptical electorate and bottom line oriented industry. The output of education is often hard to measure since the results of increased knowledge compound throughout a student's life. It is important to understand the broad impact of higher education, and therefore to use appropriate techniques to measure these impacts.

Many studies have been done on the economic impacts of particular universities using a variety of methods. In this paper we begin by classifying university economic impacts into their short and long term effects. We then offer a classification scheme of university communities by the size of their regions and by their influences. Next we suggest ways that economic impacts vary across university community types. Finally, we describe examples of short and long term studies that have been done and critique them.

Types of University Economic Impacts

Universities have broad economic effects on the regions in which they are located. Florax (1992b) separates the economic impacts of universities into "expenditure impacts" and "knowledge impacts". Expenditure impacts are simply the effects of outlays of the university. Knowledge impacts are the consequences of the production of knowledge at a university.

University and knowledge impacts differ in their relative influence over time.The local expenditure impact of a university is immediately noticeable. Knowledge impacts continue to effect the community throughout the entire lives of alumni and therefore have long term effects. While it is difficult to delineate the boundary between short and long term we use the calendar year as the unit of reference. Long term effects include the working lives of individuals and the life cycles of products and firms. These periods are usually much longer than one year. Different types of expenditure and knowledge impacts are summarized in Exhibit 1.

Exhibit 1

Types of University Impacts

	Short Term	Long Term	
Expenditure Impacts	Increased Gross Regional Product	Continued Gross Regional Product Increases	
Knowledge Impacts	Human Capital Development	**Subjective**	**Objective**
	Labor Market Changes	Increased Lifetime Earnings	Patents
		Worker Productivity	Research and Development

Expenditure Impacts

The expenditure impact of a university is the amount of sales, jobs and payroll which it generates over and above what is required to meet purely local demand. In this regard a university is no different from any other enterprise such as an airport or a factory. Expenditures of a university have immediate short term effects and lead to increases in the Gross Regional Product (GRP). Annual compounded GRP growth leads to continued regional income growth in the long term.

Knowledge Impacts

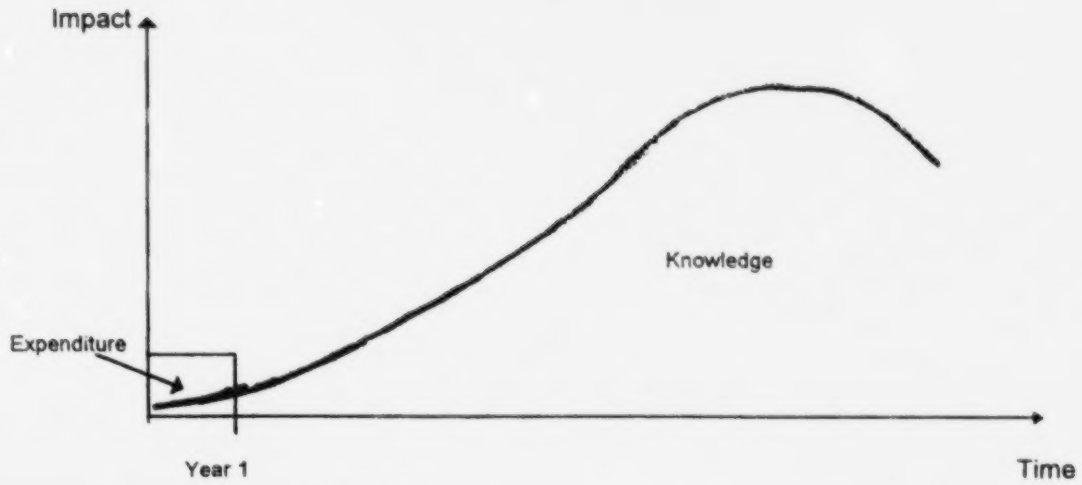
Knowledge impacts result from the transmission of ideas to the community. Machlup (1980) makes a distinction between "subjective new knowledge" and "objective" or "socially new knowledge." Subjective knowledge is produced by the passing of knowledge from faculty to students. It is new to the students but not new to society. University students receive knowledge and greater technical ability. This increase in their human capital translates into higher earnings for themselves with multiplicative benefits for the community. It also results in greater productivity for the labor force.

Subjective knowledge transfer accounts for most of knowledge impacts of universities. These effects are long term. There are also however short term knowledge effects. Individuals gain knowledge which enables them to increase their earnings quite rapidly. Universities drop and add programs in response to market conditions. These one time changes in enrollments in particular programs have short term labor effects.

"Objective" or "socially new knowledge" creation is the raison d'être of the research university. Advances in such areas as medical technology, pharmaceuticals, agronomy and computer science are made in university laboratories. New mathematical understanding is applied to the social and

natural sciences and leads to advances in knowledge. Some breakthroughs are spun off immediately to industry and have resulted in local economic benefit to such areas as Boston's Route 128 corridor and the Bay Area's Silicon Valley. While production of objective knowledge is difficult to quantify, the number of patents issued and the level of capital investment have been used as indicators.

Exhibit 2
Expenditure and Knowledge Impacts
of an Academic Year



Variations in Impacts over Time

Expenditure impacts will be greater than knowledge impacts during an academic year. Wages are paid for the classes taught, students advised, and buildings cleaned. Utilities, food and office supplies are purchased. These amounts are spent and respent throughout the community. The spending which is above the local consumption needs of the region is the expenditure impact of a university.

Graduates collect their diplomas at years end and begin trading on their expanded human capital in the labor markets. They will continue this process for the remainder of their lives thus beginning the knowledge impacts of that academic year. Over time ideas worked out in university laboratories, computers, and seminar rooms during the year will enter into commercialization.

In Exhibit 2 the levels of expenditure and knowledge economic impacts for this one year of university life are compared over time. During the initial year, expenditure impacts will be greater than knowledge impacts. Over time, however, the knowledge benefits of the increased earnings of alumni will grow to be larger than expenditure impacts.

The Determinants of University Economic Impacts

The nature and size of a university's economic impact is related to the size of the region in which it is located and to its range of influence. Some institutions are located in large diversified regions while others are in college towns. The influence of a school is related to the range of its knowledge impacts and to its importance outside of its region.

Size of Region

Higher education institutions are located in metropolitan and nonmetropolitan regions. Metropolitan regions are those defined as MSAs by the Office of Management and Budget. For nonmetropolitan institutions, the region can defined in a variety of ways. Possible definitions can include the Census Bureau economic areas, state labor market areas or state economic development areas. For community colleges the community college district boundaries can serve as the region. In the case of state universities the term region would extend to the entire state. This is because the school draws students from the whole state and is financed by taxpayers from the entire state. The expenditure impact of The University of Nebraska is great on the Lincoln MSA but the funds disbursed there are not new to the Cornhusker State. Thus the state of Nebraska should be considered the regional context for the university.

Range of Influence

The range of influence of an institution can be characterized as broad or regional. Broad influence schools have country-wide and international reputations. They draw their undergraduate and graduate students from long distances. Their alumni are dispersed throughout the world. University faculties with Nobel laureates, a continuous stream of articles are published in the top journals, and many patents are granted under their names, all evidence of national influence.

Regional influence schools draw most of their students from their regions. In turn they are the major suppliers to the local professional labor pools. They usually rank lower on qualitative indicators of scholarship and educational quality.

Exhibit 3 shows a typology of university communities by sphere of influence and community size. Plymouth State College (NH) is a nonmetropolitan regional influence institution. Located in a 3,200 resident town it draws most of its students from surrounding counties. Dartmouth College is a nonmetropolitan broad influence school located in nearby Hanover (population 6,300). Roosevelt University is a metropolitan regional influence school. Located in the "Loop" its student body is comprised mainly of Chicago area commuters. The University of Chicago, five miles to the south in

Hyde Park-Kenwood, is widely regarded as one of the top five universities in the world. It is a metropolitan broad influence institution.

Exhibit 3
Classification of University Communities
by Sphere of Influence and Size of Community

	Examples	
	Regional Influence	**Broad Influence**
Nonmetropolitan	Plymouth State (NH)	Dartmouth
	Central Washington	Whitman
Metropolitan	Northeastern	Harvard
	Roosevelt	Chicago
	San Francisco State	Stanford

Measurement of university influence

The influence of a university can be gauged by published rankings, the geographical diversity of its students and alumni, its market share and by location quotients. Ranking of institutional quality are published by such sources as Gourman (1993), each academic discipline and in the popular press. Geographical diversity can be inferred from the percentage of students from out of state which is published annually in *Barron's Profiles of American Colleges*.

The size of regional market share needs to be interpreted carefully. A metropolitan school with a large market share will be one with a strong regional influence. Yale and Notre Dame draw small shares of their students from New Haven and South Bend, respectively and this is evidence of their broad influence. Their neighboring institutions Southern Connecticut State and Indiana University, South Bend have large local market shares which can taken as indicators of their strong regional influence.

A location quotient (LQ) can also be used to measure the sphere of influence of universities. A LQ compares the ratio of the output of a local industry to local population to the same ratio for the nation. In the case of higher education the ratio of college student population to local population is compared to the national ratio. The location quotient (LQ_i) for area i is defined as:

$$LQ_i = \frac{\text{(number of college students studying in area) / (area population)}}{\text{(number of college students studying in the US) / (US population)}}$$

In 1990 approximately 7.2 percent of the US population was enrolled in an institution of higher learning. The Census Bureau counts students "as residents of the area in which they are living" (US Department of Commerce, 1990). An urban area with more than 7.2 percent of its population attending college can be considered to be a net exporter of higher education.

Location quotients are evidence of the importing or exporting status of individual regions. They cannot be used to describe the status of specific institutions. However regional influence can be inferred from a LQ if a school has a large local market share.

Exhibit 4 shows LQs in 1990 for a number of Metropolitan Statistical Areas (MSAs). Regions with LQs greater than 1.05 are net exporters of higher education. Areas with LQs of less than 0.95 are net importers. MSAs having LQs that are approximately 1 (0.95 -1.05) are net self-sufficient and serve the educational needs of their residents.

All MSAs with more than 1.5 million people are represented in the exhibit. MSAs from the midwest and upper south states were chosen for the remainder of the categories. Certain MSAs which are dominated by large universities are also included for the sake of comparison.

Among the large MSAs it is not surprising that Boston and San Francisco have large LQs. California as a whole does well with high ratios for Los Angeles, San Diego and Sacramento. Most of the other cities with high LQs are in the North and West. Most of the southern MSAs have low LQs. Perhaps the LQs for southern MSAs are lower because of the below average college attendance rates for residents in the region.

MSAs which contain large universities, not surprisingly, have the largest LQs. State College, Pennsylvania and Bloomington, Indiana have about four times the proportion of students as the national average. And the state capitols of Madison, Lincoln, Austin and Lansing have LQs which are double the national rate.

Variations in the Size of University Impacts

The extent of the economic impact of a college or university is related to the range of its influence and the character of the community in which it is located. Institutions in college towns, with either regional or broad influence, have large regional expenditure and small knowledge impacts. Metropolitan schools with regional reputations have small expenditure and large knowledge impacts. Broadly known metropolitan institutions have both large expenditure and large knowledge impacts. Exhibit 5 provides a classification of the relative sizes of economic impacts of institutions. The relative sizes of the short and long term impacts are shown for each of the categories developed in Exhibit 3.

Exhibit 4
Location Quotients for Higher Education

Net Importer (LQ<.95)		Net Self-Sufficient (.95<LQ<1.05)		Net Exporter (LQ>1.05)	
Area	**LQ**	**Area**	**LQ**	**Area**	**LQ**
Less than 350,000 Population					
Jackson TN	0.86	Clarksville-Hopkinsville, TN-KY	0.99	Bloomington IN	4.18
Benton Harbor, MI	0.83			State College, PA	3.88
Columbus, GA	0.79			Champaign-Urbana, IL	3.30
Evansville-Henderson, IN-KY	0.78			Columbia, MO	3.11
Owensboro, KY	0.71			Lafayettte, IN	3.02
Kokomo, IN	0.71			Bloomington-Normal Il	2.58
				Charlottesville, VA	2.24
				Muncie, IN	2.13
				Lincoln, NE	2.01
				Terre Haute, IN	1.33
				South Bend, IN	1.24
350,000 to 750,000 Population					
Bridgeport, CN	0.93	Knoxville, TN	0.98	Madison, WI	2.12
Charleston, SC	0.93			Lansing	2.12
Little Rock, AR	0.90			Ann Arbor	2.07
Chattanooga, TN	0.77			Lexington, KY	1.78
Fort Wayne, IN	0.77			Toledo, OH	1.26
Johnson City-K'port, TN-VA	0.74			Columbia, SC	1.25
				Spokane, WA	1.20
750,000 to 1,500,000 Population					
Richmond, VA	0.94	Norfolk, VA	1.01	Austin, TX	1.78
New Orleans, LA	0.94	San Antonio, TX	0.98	Raleigh-Durham-C H	1.52
Greensboro- W S-H P	0.92	Salt lake City, UT	0.98	Sacramento, CA	1.31
Nashville, TN	0.89			Oklahoma City	1.20
Memphis, TN	0.89			Columbus, OH	1.18
Charlotte, NC-SC	0.88			Providence, RI	1.16
Orlando, FL	0.88			Hartford, CT	1.16
Louisville KY-IN	0.85			Dayton, OH	1.08
Birmingham, AL	0.85			Rochester, NY	1.08
Jacksonville, FL	0.80				
West Palm Beach, FL	0.77				
Indianapolis, IN	0.75				
1,500,000 to 4,000,000 Population					
Cleveland, OH	0.94	Miami, FL	1.00	San Diego, CA	1.32
Houston, TX	0.94	Milwaukee, WI	0.98	Denver, CO	1.15
Pittsburgh, PA	0.94	Seattle-Tacoma, WA	0.97	Phoenix, AZ	1.10
Saint Louis, MO-IL	0.93	Portland, OR	0.95	Minneapolis, MN	1.08
Cincinnati, OH-KY-IN	0.91				
Kansas City, MO-KA	0.89				
Atlanta, GA	0.87				
Tampa-St. Petersburg, FL	0.78				
More than 4,000,000 Population					
		Chicago, IL-IN	1.02	San Francisco, CA	1.38
		Dallas-Fort Worth, TX	0.97	Boston, MA	1.23
		Philadelphia, PA-NJ-DE	0.95	Los Angeles, CA	1.16
				Washington-B'more	1.09
				Detroit, MI	1.07
				New York, NY-NJ-CT	1.06

Source: US Census Bureau, "1990 Census of Population and Housing"

Exhibit 5

Institutions and their Regions:
Economic Impact by Influence, Community Size, and Time

University Community Type	Short-Term Impact	Long-Term Impact
Nonmetropolitan - regional influence	small	large
Metropolitan - regional influence	small	large
Nonmetropolitan - broad influence	large	small
Metropolitan - broad influence	large	large

Central Washington University (CWU) in Ellensburg is a nonmetropolitan regional school in a college town. It is the primary reason for the existence of the community and a major share of the local labor force is employed there. However the true region of the institution Is the entire state of Washington. If the school did not exist resources used in its operation would be used elsewhere in the state. CWU has a low expenditure impact on the region because most of its students are from within the state. CWU has a large knowledge impact because most of its graduates remain in the state.

Central Washington University in Ellensburg is a regional influence school in a college town. It has a relatively large short term expenditure impact since it is the main industry in the city. Since the local economy cannot employ them, most of its graduates leave the area and contribute their human capital to other economies. Thus it has a small long term impact in the local economy.

Dartmouth College has a worldwide reputation. Since most of its students come from outside of New Hampshire it is a large exporter of higher education. However due to the small size of the area few of its graduates remain. Thus the short term expenditure impacts are relatively great in the region but the long term effects of increased earnings are not felt locally but are diffused throughout the world.

The expenditure impact of college town schools on their communities is quite large. However care should be taken in distinguishing the impacts of private and public institutions. Most public schools draw the majority of their student bodies from within their states. Public university expenditures, while new to the town, are not new to the state and are transfers of tax revenue from the remainder of the state to the town. Thus the export activity of a state school is limited to the students that it draws from outside the boundaries of the state. By contrast, all of the revenue from non-commuting students at a private college is new to the region.

The University of Louisville, a metropolitan regional school, draws most of its students from its region. The Louisville MSA is a net importer of higher education (LQ = .85), so that the short-term

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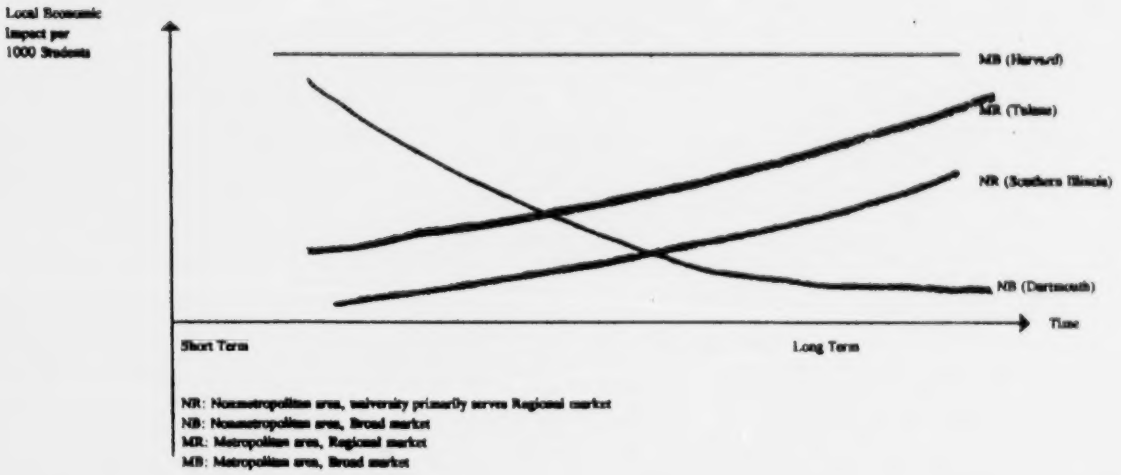
expenditures impact of higher education is minor. But since most of its alumni stay in the region it has a major long term effect through increased human capital. Harvard University is obviously a net exporter and has a significant expenditure impact in the Boston area. Since a good share of its graduates stay in the large and highly diversified region Harvard also has a great long term effect.

Exhibit 6 shows the results of Exhibit 5 in a graphical context. Over time the economic impact per thousand students of a metropolitan school with regional influence (MR) increases due to the compounding benefits on the labor force of the investment in human capital. Conversely the per capita impact of college town institutions serving a broad market (NB) declines. The impact of metropolitan schools with broad influence (MB) have both large short and long term impacts, though not as rapidly as that of regional influence schools.

Exhibit 6
Relative Size of University Impacts
by type of school (with example)



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Review of Expenditure Impact Studies

In this section we define the expenditure impact, describe the major methodologies used to estimate short range university economic impacts, and then discuss important examples of each type of study. The regional income of a metropolitan area is derived from the goods and services that it sells to other areas. New York exports financial services to the entire world. Major exports from Los Angeles include films, tourism and aircraft. Retail sales, personal services, and many other industrial sectors of a metropolitan economy are supported by the local population, and hence are not part of the export base. The sales of a university also have to be viewed in this context. Most schools have a regional focus and exist to service local demand for education. Students at these institutions are drawn from their regions and remain there after they graduate. Thus the export share of a school is that portion of its output that is above what is needed for local consumption. Its regional expenditure impact is the short term cash flow impact of the jobs, payroll and vendor payments which serve its exports.

Confusion exists in the published studies about what should be included in expenditure impacts. Some studies estimate only the share of the impacts that are derived from exports. Others describe the entire multiplied cash flow of the university as the expenditure impact.

There are four major techniques which have been used to estimate university economic impact. Three of the methods, income expenditure analysis, economic base analysis, and the input-output method are traditional tools of regional economists. The fourth, the Caffrey-Isaacs model which was developed for the American Council of Education (ACE) in 1971, is the most widely used method.

The first three methods are based on theoretical constructs of long standing. Income expenditure analysis originated with John Maynard Keynes (1936). Leontief won the Nobel Prize in Economics for his 1936 development of the input-output method. Economic base theory dates to the 1920s work of German sociologist Werner Sombart.

The ACE method, which is the most widely used one, rests upon no such body of theory. A series of impact indicators are generated on the basis of simple linear cash-flow formulas. The method is Keynesian in the sense that it uses multipliers embedded within some of the equations in the model. As a practical matter most of the multipliers that are used are pulled from other regional or national studies.

Simplified algebraic representations of each method are shown in Exhibit 7. The methods show similarities in functional form. An expenditure impact results from a defined monetary injection to the economy. This injection is increased by a multiplier of some sort. The difference between the methods is based on the definition of the injection and the nature of the multiplier which drives the model. In the economic base model the injection is derived from export income. In the expenditure multiplier model the injection is simply the expenditure of the institution. The I-O model measures sales to final users.

Income Expenditure Studies

There are about twenty studies in the literature which use the income expenditure method. Lewis (1988) cites eight done for English schools, including Cooke (1970), Dick and Wood (1980), Mallier and Rosser (1983). Brownrigg (1973) is the inspiration for the British studies. He developed an income multiplier model in which demographic aspects are taken into account. He explicitly recognizes that the impact of university expenditures on a local regional economy depends not only the magnitude of these expenditures but, as well, upon which particular sectors of the local economy the expenditures are initially made. Thus different sectors of the economy will have different multipliers. The multiplier of university spending on the housing sector will be different than it will be for consumer durables.

Armstrong (1992) uses a Keynesian local open economy multiplier to measure the impact of Lancaster University (U. K.), a metropolitan regional influence school, on its area. The university employs 1352 people and is responsible for 351 more jobs or about a 26% increase in employment. He found a multiplier of 1.82 for total university expenditures.

Armstrong reduced the amount of initial university expenditures to account for initial injection leakages. The denominator in his equation includes the marginal propensities to create income in the private sector, consume, pay tax, give up government benefits and to import into the region. His equation includes such local economic coefficients as direct employment totals and average wage, ratio of public and private employment, expenditure to create a public job.

Exhibit 7
Algebraic Summary of Expenditure Methods
Used in University Impact Studies

Method	I = Injection	m= Multiplier
Economic Base	ΔX X = export income where $\Delta X=(LQ-1)/LQ$	(Y/X) Y= total income, X= export income
Input-Output	ΔF F = Sales to final users	$(I-A)^{-1}$ A = a matrix of production recipes showing linkages between local industries I = identity matrix
Income Expenditure	University community spending	1/(1-b + d) b = marginal propensity to consume locally d = marginal propensity to import
ACE	$\Sigma (U_i L_i)$; U = university community. I = university, faculty/staff, students, visitors L = local spending/total spending	$(I + I_m + P_u + G(b-c) + WJ)/I$ I_m = Business multiplier P_u = Value of property dedicated to servicing university business G(b-c) = benefits and costs to local governments. W= Wages J= Jobs created by university

Lewis (1988a) used a simpler Keynesian multiplier analysis for Wolverhampton Polytechnic (UK), a metropolitan regional influence school, and found a multiplier of 1.70. He also found a jobs multiplier of 1.57. Bleaney et. al. (1992) estimated a multiplier of 1.56 for the University of Nottingham (UK) which is a metropolitan regional school.

ACE Studies

The Caffrey-Isaacs model developed for the American Council of Education (ACE) in 1971 is the most widely used method for calculating the economic impact of universities. Leslie and Slaughter (1992) summarize 65 studies which have used this method. Undoubtedly there are many more. They found that the average spending multiplier in these studies was 1.82. They also found that on average each million dollars in the average university budget added 53 jobs to its region.

The initial step in the ACE method is to identify the expenditures of the university community. Expenditures include direct institutional spending to area vendors and local spending by faculty, staff

and students and visitors. Student spending includes only those payments in the local economy above direct payments to the institution for tuition, housing and food.

A regional economic multiplier is applied to the total impact of local spending by the institution, employees, students, and visitors. In practice, multipliers are borrowed from other studies and inserted into particular local economic impact studies.

The competitive effects of university enterprises, such as dormitories and food services, on area merchants are subtracted from the total local business impact. Other financial activities which are supported by university community expenditures are added. This includes the value of local business inventory, real and nonreal property. Expansions of the local credit base made possible by university community deposits are also included.

Benefits and costs of the university on area governments are estimated. These are summarized in Exhibit 8. Benefits include local property taxes paid by faculty, staff and students, state school aid for university community children and the institutional performance of municipal functions such as security and generation of power. Costs include real estate taxes foregone and the cost of government functions to service university property and people.

Finally the labor market impact of the increase in jobs in the area is estimated. Care is taken to subtract the actual number of university employees from the total number of jobs created.

Exhibit 8
Economic Impact on Area Governments

Benefits	Costs
Property taxes of employees	Real estate, other property taxes foregone
State school aid for employee and student children	Cost of government services to the university community e.g. education, police, fire
Institutional performance of government functions e.g. security, utilities	Maintenance of government property which serves the university

Caffrey and Isaacs make no distinction between the expenditure impacts of local and nonlocal students. Elliot, Levin and Meisel (1988) realize this serious omission and recommend that student spending should be counted only for students who rely on funding from outside the region. The spending of local students can be counted if they would have left the region for education had the institution not been in existence. In a further attempt to address this issue they suggest that institutional funding should be counted if its source is external to the region. This would mean that much of the funds for many community colleges which depend on property tax revenue would be excluded under this criterion. They conclude with a caveat that funds which are new to the region may not be new to the state and are merely resource transfer.

Few studies which use the ACE method have been published. Among them is Stewart et. al. (1989) which was done for South Carolina State College. No distinction was made between in-state and out-of-state students. They state that the statewide multiplier for the college was 3.82 while the regional multiplier was 2.29. However these multipliers were derived from other sources.

Stokes (1994) used the ACE method in a study for Andrews University of Berrien Springs, Michigan. Andrews is a church related institution with an enrollment of approximately 3000. About 75% of the students come from outside the Benton Harbor, Michigan MSA. He arrived at an economic impact of $157 million. He examined the impacts on local business, governments and labor markets. Also included are the increased earnings of local alumni due to their college education.

Economic Base Studies

A city lives and grows by what it provides for outside economies. In economic base (EB) methodology an urban area is divided into a basic or exporting sector and a nonbasic or local production sector. The portion of higher education output which serves the demand of other regions is in the basic sector. The education of the native population is included in the nonbasic sector. The nonbasic sector does not add to the economic activity of the region. It is income derived from the export of goods and services that provides for local spending on education.

There are about twenty university impact studies in the literature which use the economic base method. One of the earliest is a study for the University of Bridgeport in Connecticut by Kraushaar (1964). Moore (1979) did an estimate of the impact of the New York State University System on the state at the county level. The injection into the New York economy is based on payroll, student spending, capital construction, local supply purchases. Only nonlocal student spending is included. However true opportunity cost is not dealt with. Most students, though not local, come from within the

state. Therefore the source of nontuition funds would be tax dollars which also are not new to the state. Interestingly Moore shows a redistribution of funds from New York City to rural and urban upstate counties.

Smith and Bissonette (1989) estimate the benefit to cost ratio for nonresident students on the economy of West Virginia to be 3.02. They do not include university expenditures which are internally generated tax money.

Input-Output Studies

The input-output (I-O) method can be used to derive the multiplier of an additive injection to economy. An input-output model was first developed by Leontief (1936). Early examples of applying I-O to the measurement of university impact include Blake and McDowell (1967) and Bonner (1968).There are some fifteen I-O studies in the literature, most of them appearing in the 1970s.

Lilles and Tonkovich (1976) estimated the effects of external research grant money received by Washington State University on the state. They found a spending multiplier of 1.27. Goodman and Weiler (1992) used their method to estimate the income and employment impacts within Minnesota resulting from federally funded research grants in 1985-1986 at the University of Minnesota. They found a multiplier of "at least 2.5."

Goldstein (1990) estimated a multiplier of 2.0 for the sponsored research budget of the University of North Carolina at Chapel Hill. He took special care to limit his analysis to local impacts. Intra-university funds and grants from other state agencies were subtracted from his calculations. The latter are not increases in economic activity but are at the cost of other recipients in the state. Out-of state expenditures, leakages from North Carolina, were excluded also.

Hedrick, Henson and Mack (1990) examine the question of whether the traditional view of a complementary relationship between universities and local businesses is still appropriate or whether such auxiliary activities as bookstores and food service have changed this relationship. Cross-sectional data on over 3100 counties and 3300 institutions are used to analyze the effects of university enrollments and auxiliary activities on county-level employment in the retail, financial and service sectors. Their findings indicate that the negative effects of university auxiliary activities are confined to relatively small counties, are small in magnitude, and are more than offset by the positive spending effects by universities and their students. The overall impact is positive, is more pronounced in more populous counties and has increased over time.

Coomes and Gohmann (1994) estimated a multiplier of 1.8 for the total impact of revenues to firms for a $10 million change in net new revenues to the University of Louisville. They also found a jobs multiplier of 2.11 and a payroll multiplier of 1.48. The relatively low latter figure is due to the fact that high paying university jobs generate primarily lower paying retail and service jobs in the local economy. They used and 500 sector regionalized input-output model of the Louisville metropolitan area economy. They perturbed one of the sectors, entitled "Colleges and Universities", and tracked the impact through the simulated local economy. The $10 million change in university revenues was assumed to be due to new external grants and contracts, an increase in nonresident student credit hours, or an increase in the university's share of the state's higher education budget allotment.

Econometric Studies

Econometric functional forms can be applied to the methods described above with the exception of the ACE technique. A small number of studies have used econometric analysis to estimate the regional economic impact of universities (Fishkind, Millman, and Ellsen, 1978; Engler, Fimberg, and Kuhn, 1980; Olson, 1981; Brown and Johnson, 1987).

Gana (1993), in a study for the University of Delaware (UD), regressed Delaware wages on UD nonresident enrollment and state business earnings and found that out of state students induced $18 million in expenditures in 1991-1992. While he does not state a multiplier I have estimated a value of 1.19 based on the information in the report.

Knowledge Impact Studies

Florax (1992a, p. 186) summarizes regional economic research into knowledge impacts of universities. These are arranged in Exhibit 9 by author, the relevant influencing factor of the university and the nature of its impact. Most of the cited studies develop models which estimate the influence of the university sector upon regional economies. Universities are seen to affect the location of innovative and "high tech" firms as well as the development of patents. All of these doubtless have impacts on regional economies though the exact level is indeterminate. Other studies estimate the impact of higher education on regional income and employment. Very few studies have been done on the knowledge impacts of particular universities.

Exhibit 9
Summary of Knowledge Impact Studies

Author	Date	Independent Variable (Influencing factor)	Dependent Variable (Type of impact)
Location Analysis, Relevance of Locational Factors			
Premus	1982	Nearness to universities Availability of skilled labor	location of high tech firm
Bouman	1986	Nearness to research universities	location of R & D, corporate headquarters, high-skilled jobs
Markusen	1986	Research spending	location of high-tech firms
Buck & Rcelofs	1987	Universities	location of spin-off firms
Spatial Innovation Research, Differences over Space of Potential and Actual Innovations			
OECD	1984	Universities Metropolitan areas	Innovation generating capacity
Oakey	1981	research institution	Innovations
Karlsson	1988	Highly skilled labor	Transportation & communication
Andersson et. al.	1990	Number of full professors	Regional Production
Stenberg	1990	Knowledge production number of graduates	Regional growth in 3 industries
Smith & Drabenstott	1991	University spending/capita R & D spending/capita	Growth in real personal income State employment
Science & engineering PhDs, Research output			
Jaffe	1989	University R &D	Patents

Spatial econometric method

Florax (1992a) developed a spatial econometric model to estimate the regional effects of knowledge production of Dutch universities. He analyzed the effects of university expenditure and the diffusion of knowledge on investment in manufacturing building and equipment. Diffusion is related the degree of urbanization, urban ranking and the distance from the Amsterdam Rotterdam corridor.

Following Hagerstrand (1965; 1967) Florax distinguished between contagious diffusion hierarchical diffusion. "In the contagious case, the diffusion of knowledge is concentrated within the vicinity of the originating source and decays strongly with distance. In the hierarchical case, knowledge diffuses at first instance among central places, and at a later stage it successively trickles down to places of lower order. The diffusion among places of high order may be expected to be faster than among places of lower order, because the former have greater access to the knowledge infrastructure due to the presence of research, education and consultancy facilities. Furthermore, places high up in the hierarchy are connected to the main transportation and communication networks and they have a better educated work force." (p. 184)

Florax's conclusions are not surprising. He finds that business investment is positively related to university expenditures and output. It is negatively related to capital cost. It is also negatively related to distance from the Dutch population core which is centered around Amsterdam and Rotterdam. From his results one might conclude that high quality rural schools are less effective than urban research schools.

Business investment is also related to the degree of hierarchical knowledge diffusion. This means that business investment is greater in larger metropolitan areas which have clusters of major universities. Intuitively knowledge spreads faster at closely situated schools and is even greater if laboratories of major corporations are nearby as they would be in large areas.

Some caveats are in order. University expenditures as a proxy for knowledge production may not be adequate. There is also the question as to whether results found in the small and compact Dutch scene are applicable to the United States as a whole. Perhaps the conclusions might be more applicable to the compact northeast states which have approximately the same density.

Human Capital Method

Another means for estimating long term impact of universities is the human capital method. The origins of human capital theory can be traced to the work of Becker (1962, 1964) and Mincer (1974). They developed the idea that investments in human beings can be treated much as investments in physical capital such as buildings and machines. People will, according to the theory, keep on investing in human capital as long as the rate of return on marginal investments is greater than the rate of return on the next best investment. Another way of looking at it is to say that a person will

continue to invest in education as long as the present value of the increases in future earnings is greater than the present value of the costs of that education (tuition, foregone earnings, etc.).

The optimal investment from society's point of view occurs when the present value of the benefits just equals the present value of the costs. Social costs include subsidies to public education. Psacharopoulos (1985) estimates that the private rate of return to higher education to individuals in advanced countries is 12% while the social rate of return is 9%. Social returns are defined as total returns minus tuition, fees and educational appropriations.

It is well established that the average college graduate has higher lifetime earnings than does the average high school graduate. The personal return to education is the present value of this difference between these earnings levels. Average earnings for individuals vary based on age, gender, race, education and experience. Additionally expected lifetime earnings vary by the probability of working at each age, the probability of surviving to each age, the growth in wages and the rate of interest.

Hundreds of studies have been done to estimate the returns to education at the macroeconomic, regional, program and individual levels. Few studies have estimated the human capital impacts of individual institutions. This can be done by summing up the total of the increased earnings for alumni of a particular institution. Bluestone (1993) used the human capital method to estimate the impact of the University of Massachusetts at Boston (UMB), a metropolitan regional school. Total public and private spending of $58 million yielded an increased lifetime income stream of $471 million at present values. He estimated that the state government can expect to receive $1.57 in personal income and sales taxes for every $1 it spends on UMB students. The rate of return of 8.9% to the state is very close to the estimate of Psacharopoulos.

Berger and Black (1993) analyzed the human capital impact of public higher education in Kentucky. They estimate that private returns to higher education in 1992-1993 were $8.33 billion which was 13.8% of personal income. Social returns were estimated at $7.25 billion.

Stokes (1995) estimated the knowledge impact of Jefferson Community College in Louisville, Kentucky using the Berger and Black method. He found the human capital impact to be $168 million for the 1993-1994 academic year. On average the estimated present value of lifetime earnings of two years of college education is $127,000 more than that for a high school graduate.

Prior studies have shown that completion of a bachelors degree increases average lifetime earnings. Work by Kane and Rouse (1995) demonstrates that portions of college education also increases lifetime earnings potential. Thus Stokes assumed that each completed semester increased lifetime earnings potential by the fraction of the difference in expected life time earnings between two years of college and a high school diploma. Following Stokes, the total knowledge impact of the institution was calculated by summing up the increased expected lifetime earnings for each student. For an individual student the following formula was used to calculate the expected addition to lifetime earnings for one completed semester:

$$\text{Increased earnings} = \{\text{expected lifetime earnings increase}\}_{r,g,a+c} \times \{\text{completed credit hours}/60\}$$

In the formula above r= race, g = gender and "a" represents the age of the person at the time he or she is enrolled. The subscript "c" denotes the time it would take the individual to complete sixty semester hours or two years of college at his or her current rate of progress. College completion time would be:

$$c = \{60/\text{attempted credit hours in current semester}\} / 2$$

Assume for example that an 18 year old female completes twelve hours in a semester. If she continues at that rate she can expect to complete an Associates degree in two and a half years. Let us further assume that at the age of 20.5 she can expect to earn $100,000 more in current dollars over her lifetime than can a comparable high school graduate. She will have increased her earnings potential at the end of the semester by $20,000 or 20% of her lifetime total since she is one fifth of the way toward her Associate's Degree.

The total college long term impact comes from adding up the results for all of the age groups. The following formula was used to calculate the expected addition to lifetime earnings for both semesters and for each gender-race-age group:

$$\text{College long term impact} = \sum_{r,g,a+c} [\{\text{Individual increased earnings}\} \times \{\text{Retention rate}\}]$$

Let us presume that the retention rate for 18 year old white females is 65%. Then the result for 1000 18 year olds attempting an average of twelve hours in a particular semester would be:

$$\$13{,}000{,}000 = \{1000\} \times \{\$20{,}000\} \times \{.65\}$$

Comparison of Study Results

Exhibit 10 summarizes the results of economic impact studies for selected schools. Studies chosen by Leslie and Slaughter (1992) as demonstrating the highest levels of "validity and clarity", as well as other studies referenced in this paper, are included. In Exhibit 10 each school is assigned to a category based upon its influence and regional size. The influence status of a school was based on its score in Gourman (1993) and the percentage of out of state students listed in *Barron's Profiles of American Colleges* (1994). Most of the schools listed have a regional influence and are located in metropolitan areas.

Most of the university economic impact studies estimated the short term economic impacts of universities, primarily using the ACE method. The average spending multiplier found in these studies is 1.9 with a range from 1.4 to 4.7. For comparison purposes the ratio of business volume to college budget has been included for studies selected by Leslie and Slaughter. They define it as "the sum of local college, employer and, student, and visitor spending, including multiplier impact, divided by education and general expenditure."

For studies using the human capital method the multiplier is based on the ratio of the present value of increased earnings to the total public and private educational expenditure. While it is difficult to liken short term expenditures to long term impacts some comparisons can be made. It is true that society does not reap the full benefit of increased life time earnings streams in each year. Society, however, does gain annually from the cumulative increased earnings of past cohorts of graduates working in a particular year.

The average expenditure multiplier for studies using the ACE method was 2.0. It is not clear whether these multipliers came from the results of the study or were borrowed from other regional economic studies. The average multiplier for I-O studies was 1.9. Expenditure multiplier studies had a slightly lower average value of 1.6. It can be concluded that regardless of the method estimated multipliers for short term impacts are similar in magnitude. Therefore choice of method would depend upon considerations of accuracy and ease of performance and effect.

Exhibit 10
Multipliers for University Impact Studies
By Influence and Size

SCHOOL	METRO AREA	spend mult	bus vol /coll. budg.	acad. rank	% out state students	influ-ence	area size	METHOD
Andrews	Benton Harbor, MI			2.81	64	broad	metro	ACE
Brown	Providence, RI	1.9	0.9	4.78	97	broad	metro	ACE
California, Santa Cruz	Santa Cruz, CA	2.2	2.5	4.10	10	broad	metro	ACE
Carnegie-Mellon	Pittsburgh, PA	1.5	1.2	4.72	70	broad	metro	ACE
Creighton	Omaha, NE	2.0	2	3.79	53	broad	metro	ACE
Delaware	Philadelphia, PA	1.2		3.97	58	broad	metro	Econometric
Drake	Des Moines, IO	1.9	2.3	3.40	67	broad	metro	ACE
Miami	Miami, FL	4.7	3.9	3.77	49	broad	metro	ACE
North Carolina	Raleigh-Durham, NC	2.0		4.68	18	broad	metro	IO
Oregon	Eugene, OR	2.0	1.8	4.21	33	broad	metro	ACE
Pacific	Portland, OR	1.3	0.6	3.10	53	broad	metro	ACE
Virginia	Charlottesville, VA	1.6	1.4	4.61	35	broad	metro	ACE
Wisconsin	Madison, WI	2.2	1.7	4.87	35	broad	metro	ACE, IO
Alaska	Fairbanks, AK	1.2	1.4	3.44	14	region	metro	ACE
Bridgeport	Bridgeport, CT	1.9	0.9	3.47	42	region	metro	ACE
California State (Pa)	Pittsburgh, PA	1.4	.5/1.2	3.28	6	region	metro	ACE
Edinboro State	Erie, PA	2.0	2.1	3.25	13	region	metro	ACE
Evansville	Evansville, IN	2.7	1.8	3.16		region	metro	EB
Georgia State	Atlanta, GA	1.5		3.34	7	region	metro	ACE
Indiana - Southeast	Louisville, KY-IN	1.8	2.5	3.15	1	region	metro	ACE
Jacksonville State	Anniston, AL	2.2	4.2	2.95	18	region	metro	ACE
Jefferson Community	Louisville, KY-IN	8.4			3	region	metro	hum cap
Lancaster	Manchester, UK	1.8				region	metro	exp mult
Louisville	Louisville, KY-IN	1.8		3.61	9	region	metro	IO
Maine	Bangor, ME	1.8	2.1	3.98	17	region	metro	ACE
Massachussetts - Boston	Boston, MA	8.1		3.25	4	region	metro	Hum cap
Northeastern Illinois	Chicago, IL	2.0	2.5	3.47	1	region	metro	ACE
Nottingham	Nottingham, UK	1.3				region	metro	exp mult
Oklahoma State	Stillwater, OK	1.8	1.3	3.69	14	region	metro	ACE
Southern Illinois-Edwardsville	St. Louis, MO-IL	3.0		3.32	13	region	metro	ACE
Trenton State	Trenton, NJ	1.9	0.9	3.22	9	region	metro	ACE
Whittier	Los Angeles, CA	3.4	1.6	3.01	33	region	metro	ACE
Wisconsin-Green Bay	Green Bay, WI	1.9	2.4	3.28	5	region	metro	ACE
Wolverhampton	Birmingham, UK	1.7				region	metro	exp mult
Black Hills State	Spearfish, SD	1.9	1.3	3.01	28	region	rural	ACE
Eastern New Mexico	Portales, NM	1.6	1.4	3.12	26	region	rural	ACE
Mankato State	Mankato, MN	1.9	2.3	3.13	20	region	rural	ACE
Shippensburg State	Shippensburg, PA	1.9	1.9	3.10	9	region	rural	ACE
Western Illinois	Macomb, IL	2.0	1.4	3.40	7	region	rural	ACE
	Average	2.3	1.9	3.6				

Sources:

Spending multipliers reported in study or by Leslie and Slaughter (1992)
Academic rank reported in Gourman (1993)
Population from the 1990 Census of Population and Housing
Percent out of state from Barrons Profiles of American Colleges

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The multipliers shown for the Leslie and Slaughter studies are the ones they list. It is not clear whether these values were derived from the analysis of the study authors or were borrowed from other regional economic studies.

Criteria for judging impact methods

Methods are more accurate when distinctions are made between the export sector and goods and services that are produced for local consumption. The economic base, I-O and expenditure multiplier models are clear in making that distinction. The ACE model as generally used does not separate out the spending of local and nonlocal students. Hence though there is little difference in the size of the multiplier ACE studies will tend to overstate the regional impact of a university.

The ease with which a study can be accomplished depends upon the availability of data and economic models. I-O and expenditure multiplier methods are easy to apply to university impacts provided the initial regional modeling and data collection has been done. Data collection is not difficult while the model building is daunting. The ACE method requires the collection of much accounting data which, while not hard to find, is cumbersome to accumulate. Most often these data are then linked to a multiplier borrowed from another regional study.

Recommendations on the choice of method

Economic impact studies are a popular public relations tool of universities. They are used for development purposes to convince corporate benefactors and the holders of legislative purse strings of the value of increasing support for the institution. Many studies appear to have been undertaken without a real understanding of the relationship between the school and the community it serves.

Metropolitan regional schools have relatively low expenditure impacts and large knowledge impacts on their communities. While their actual financial outlays may be great most of their activity is devoted to servicing locally generated demand. This is because most of their students are drawn from the cites which they serve and most of their alumni reside there. In that sense, they are not part of what economists call the export base of the regional economy. Their true expenditure impact is limited to that portion of their spending that is derived from exports. Conversely metropolitan regional schools have large knowledge impacts. Since most of their alumni remain in the community it benefits from greater life time productivity and earnings due to the investment in human capital.

Before communicating their value to the public, metropolitan regional schools should use research methods that highlight their large knowledge impacts. Traditional studies which focus on expenditure impacts overstate their influence by not separating out the import and export components. On the other hand, traditional methods which view colleges and universities on a short term cash flow basis understate the long term returns to the local investment in human capital. Knowledge impact studies highlight the real developmental mission of the institution.

Metropolitan schools with broad reputations have both high expenditure and high knowledge impacts. Since they draw students from long distances they are exporting enterprises. Most of their local outlays can be counted as an expenditure impact. Their knowledge impacts are relatively great since large shares of their alumni remain in the community. Also their research often results in commercial applications which benefits local industry, sometimes creating new local industries.

Regional impact studies done for such schools can legitimately focus on either knowledge or expenditure influences. Expenditures will be large but may not serve to distinguish the contribution of the school that are different from other civic institutions. Knowledge impact which studies focus only on human capital growth may also miss some of the dimensions of the contribution. Universities such as Harvard or Stanford have influenced their regions at all levels including governance and policy decisions, industrial location, product development and human capital infrastructure. Thus knowledge impact studies should be varied and multidimensional.

Small town regional schools have relatively low expenditure impacts because they are not exporting institutions. They do have large knowledge impacts if the true extent of their regions is considered. If the region is considered as merely the municipality in which it is located then its knowledge impact is small (in absolute terms) because most of the graduates leave the town. However if the region is considered to be a portion of a state or an entire state then the knowledge impact is quite large. This is because large shares of the graduates remain in the region.

Small town regional schools would be better served using knowledge impact studies. They should be careful to define their regions to the largest defensible extent. Small town schools with broad reputations have large expenditure impacts because they draw students from long distances and are therefore exporting enterprises. They have low knowledge impacts because most of their alumni leave

the area. However those that remain are likely to be highly visible. Thus a knowledge impact study which is leveraged to take advantage of this visibility would be a valuable one.

Conclusion

We began this paper by categorizing university impacts into short and long term influences and into expenditure and knowledge effects We then classified university communities by sphere of influence and size. In Exhibit 5 we examined the relative size of university economic impact by influence, size and time. We went on to describe several methods that have been used to estimate impacts and described examples of each method. We concluded by considering the appropriateness of the different methods for particular universities.

Studies of the impact are generally performed for very practical reasons. Governments are attempting to allocate scarce resources between continually clamoring real needs and interest groups. It is well known that higher education has long term effects, for the individual students and the communities they live in. Occasionally, higher education loses political favor in the competition for public funds. Individual institutions commission impact studies to remind the public of the school's value in hopes of extracting more contributions, tax dollars and concessions. With this in mind it is important to produce reports that are both intellectually honest and measure the the manifest economic impacts of the institutions.

In this article we have classified educational economic impacts into expenditure and knowledge impacts. The former generally have measurable short term impacts while the latter are long term effects. A school which brings in relatively many students from outside its region is a net exporter and has a large expenditure impact. If many of its graduates remain in the community then has a large knowledge impact. A school which relies on a local population base for its students is a not an exporter and has a small expenditure impact. Since many of its students remain however it has a large long term knowledge impact.

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